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(54) Title of the Invention

MICROSTRIP ANTENNA USED IN COMMON WITH TWO FREQUENCIES

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Description

1. Title of the Invention

MICROSTRIP ANTENNA USED IN COMMON WITH TWO FREQUENCIES

2. Scope of the Claim for Patent

A microstrip antenna used in common with two frequencies including: a radiation strip conductor disposed by way of a dielectric layer or an air layer to a ground conductor; a feeder post for feeding to the radiation strip conductor; a non-feed load post disposed between the ground conductor and the radiation strip conductor; and a reactance element connected to the non-feed load post.

3. Detailed Description of the Invention

[Technical Field of the Invention]

The present invention concerns a microstrip antenna used in common with two frequencies usable for two frequencies.

[Technical Background of the Invention]

An existent microstrip antenna used in common with two frequencies is constituted as shown in Fig. 1 and Fig. 2. Fig. 1 is a perspective view and Fig. 2 is a side elevational view.

In both of Fig. 1 and Fig. 2, a center post 1 serves to support a radiation strip conductor 2 of a radius a by way of an air layer at a thickness d. A ground conductor plate 3 is placed by way of the air layer to the radiation strip conductor 2. A diode load post 4 is disposed at a position spaced by a distance r_3 from the axial center of the center post 1. A diode 5 is loaded on the diode load post 4.

A feed post 6 of a diameter 2rf is disposed spaced apart by a distance r_1 from the axial center of the center post 1. A feed line 7 is connected to the feed post 6 so that electric power is fed by way of the feed line 7 to the radiation strip conductor 2.

As described above, impedance has been matched for desired two frequencies by using the diode 5 and turning the diode 5 to on or off for desired two frequencies thereby changing the load reactance of the diode load post 4 under no power feed between 0 and ∞ in an equivalent manner.

It has been designed, for example, such that the impedance is matched in the on-state of the diode 5 (load reactance = 0) at a frequency $f = f_1$, and the impedance is matched in the off-state of the diode (load reactance = ∞) at $f = f_2$.

[Problems in the Background Art]

Accordingly, in the existent microstrip antenna used in common with two frequencies, not only a control circuit is necessary for controlling the on and off of the diode depending on the frequency used but also relevant power source and driver cables are required to make the constitution complicated and inconvenient. Further, the existent microstrip antenna used in common with two frequencies is used while switching the frequency to be used by the on-off of the diode and can not be used simultaneously in common with two desired frequencies.

[Object of the Invention]

The present invention has been achieved in view of the foregoing situations and intends to provide a microstrip antenna used in common with two frequencies not requiring additional cable, power source, and control circuit and capable of using two frequencies in common simultaneously.

[Summary of the Invention]

According to the microstrip antenna used in common with two frequencies of the invention, a non-feed post is disposed in addition to the feed post and a reactance that changes depending on the frequency is loaded to the non-feed post so that the antenna can be utilized for different two frequencies.

[Example of the Invention]

The present invention is to be described by way of an example of a microstrip antenna used in common with two frequencies with reference to the drawings. Fig. 3 and Fig. 4 are view showing the constitution of the example. Fig. 3 is a perspective view and Fig. 4 is a side elevational view which correspond to Fig. 1 and Fig. 2, respectively.

In Fig. 3 and Fig. 4, identical portions with those in Fig. 1 and Fig. 2 carry identical reference numerals to omit the description therefor for avoiding duplication, and those portions different from Fig. 1 and Fig. 2 are to be described mainly.

In the example shown in Fig. 3 and Fig. 4, a non-feed load post 8 is provided in addition to a center post 1 for supporting a radiation strip conductor 2 over an air layer of thickness d and a feed post 6, and a reactance element 9 is loaded to the post. The load post 8 is loaded with a reactance element 9, and has such a frequency property that

the load reactance changes between 0 and ∞ for the two frequencies by utilizing resonance and anti resonance phenomenon thereof. The load post 8 is disposed at a distance r_2 from the center post 1.

The reactance element 9 is constituted with a reactance line, for example, as shown in Fig. 5. Terminals 91, 92 are connected with the load post 8 and terminals 93, 94 and terminals 95 and 96 are opened.

In the example shown in Fig. 3 and Fig. 4, each of the dimensional conditions are set as:

a = 10 cm (radius for radiation strip conductor 2)

d = 1.2 cm (thickness of air layer)

r_1 = 4 cm (distance between each of the axial centers for center post 1 and feed post 6)

r_2 = 5 cm (distance between each of the axial centers for center post 1 and load post 8)

r_f = 0.05 cm (radius for feed post 6)

In the reactance element 9 shown in Fig. 5, a line having a characteristic impedance: $R_c = 50\ \Omega$ was used and, in a case of setting each length as: L_1 = 28.23 cm, L_2 = 28.23 cm, and L_3 = 6.44 cm, the load reactance is 0 at f_1 = 858 MHz and ∞ at f_2 = 798 MHz.

Fig. 6 is a view showing the input impedance characteristic in this case.

As apparent from Fig. 6, it can be seen that impedance

is matched for the two frequencies:

f_1 = 858 MHz,

f_2 = 798 MHz.

The microstrip antenna in this example can be used simultaneously for the frequencies f_1 and f_2.

Fig. 7 and Fig. 8 show a second example of the invention respectively. Fig. 7 is a perspective view and Fig. 8 is a side elevational view. They correspond to Fig. 3 and Fig. 4, respectively.

In the second example, two non-feed load posts 8a, 8b are disposed. That is, the load post 8a is disposed at a distance r_3 from the center post 1 and the load post 8b is disposed at a distance r_2 from the center post 1, respectively and, further, a reactance element 10 is loaded to load post 8a.

The reactance element 10 is constituted with a reactance line, for example, as shown in Fig. 9. The terminals 11, 12 are connected to the load post 8a, and the terminals 13, 14 and 15, 16 are opened.

In the second example, each of the dimensional conditions is set as:

a = 10 cm (radius for radiation strip conductor 2)

d = 1.2 cm (thickness of air layer)

r_1 = 4 cm (distance between each of the axial centers for center post 1 and feed post 6)

r_2 = 1 cm (distance between each of the axial centers

for center post 1 and load post 8b)

r_3 = 5 cm (distance between each of the axial centers for center post 1 and load post 8a)

r_f = 0.05 cm (radius for feed post 6)

In the reactance element 10, a line with a characteristic impedance: $R_c = 50\ \Omega$ was used and, in a case of setting each length as: L_1 = 28.13 cm, L_2 = 28.13 cm, and L_3 = 6.48 cm, the load reactance is 0 at f_1 = 860 MHz and ∞ at f_2 = 800 MHz.

Fig. 10 is a view showing the input impedance characteristic in this case.

It can be seen that matching is taken for the two frequencies:

f_1 = 860 MHz,

f_2 = 800 MHz.

The microstrip antenna in the second example can be used simultaneously for the frequencies f_1 and f_2.

In the two examples described above, while the cases of using one and two non-feed load posts are shown, good characteristics can be obtained generally by using plural posts.

Further, also the reactance value is not restricted to 0 and ∞ for desired two frequencies and can be set optionally. In this case, parameters include the value for the input impedance, frequency spacing between the desired two frequency,

etc.

Further, also the shape of the radiation strip conductor is not of course restricted to the circular shape, and a dielectric layer may be disposed between the radiation strip conductor 2 and the ground conductor plate 3. In this case, the center post 1 may be saved.

[Effect of the Invention]

As described above, the microstrip antenna used in common with two frequencies of the invention can be utilized for different two differences easily and simultaneously with no additional requirement for the power source, the control circuit, the cable, etc. and provide a remarkable practical effect.

4. Brief Description of the Drawings

Fig. 1 and Fig. 2 are views for explaining the constitution of an existent microstrip antenna used in common with two frequencies, Fig. 3 and Fig. 4 are views for explaining the constitution of an example of the microstrip antenna used in common with two frequencies according to the invention, Fig. 5 is a view for explaining a reactance element shown in Fig. 3 and Fig. 4, Fig. 6 is an input impedance characteristic diagram of a microstrip antenna used in common with two frequencies shown in Fig. 3 and Fig. 4, Fig. 7 and

Fig. 8 are views for explaining the constitution of another example of the microstrip antenna used in common with two frequencies according to the invention, Fig. 9 is a view for explaining the reactance element shown in Fig. 7 and Fig. 8, and Fig. 10 is an input impedance characteristic diagram for a microstrip antenna used in common with two frequencies shown in Fig. 7 and Fig. 8.

1	center post
2	radiation strip conductor
3	ground conductor plate
6	feed post
7	feed line
8, 8a, 8b	load post
9, 10	reactance element